midst of such an atmosphere it is not surprising that the development of a true Renaissance spirit has been somewhat tardy.

But the British nation is on the eve of an awakening, an awakening which has already taken place among certain leaders of thought. The fact is dawning upon the British mind that some vital connection really does exist between national progress and scientific discovery, and that the latter should be fostered in connection with the higher institutions of learning. Under the conviction that British commercial supremacy will be seriously threatened unless foreign, and especially German, scientific methods are adopted, universities of a more modern type than Oxford and Cambridge, and also technical colleges, have been established. Such institutions no doubt fill a long-felt want, but they do not go to the root of the matter. On the academic side they are but a modification of the older type; on the technical side they contemplate, not the discovery of new truth, but the application of what is already known. The spirit of research is lacking, and without it no expenditure of money, no raising of examination standards for mere acquirement, will actually increase the capital account of national knowledge.

The policy of the universities of the United States regarding this matter is in marked contrast with the indecision and conservatism which prevail in the mother country. The type of mind which has been developed in the century and a quarter of separate national existence is one of great vigour and originality; but these qualities have for the most part been turned aside by the circumstances of a new country from abstract investigations. Research after the almighty dollar by the nearest short-cut has been, and perhaps still is, regarded as the chief national characteristic of our American cousins, and in this pursuit they have displayed a genius for concrete research in mechanical invention and an ability for commercial and industrial enterprise which have been an object of wonder, and latterly of anxiety, to other nations. During the first hundred years of national existence the university of the gymnasium type which had been inherited from England continued to develop and expand in the United States. Suddenly, however, almost exactly twenty-five years ago, a remarkable modification was introduced.

Since 1877 many universities, including the best of those already in operation, as well as new foundations, have added a graduate department leading to the Ph.D. degree, although none of these, with the exception of Clark University, has made the prosecution of research the sole business of the university. Some idea of the rapid progress of this movement may be gathered from the fact that the numbers pursuing graduate studies in the universities of the United States have increased from 8 in 1850 to 399 in 1875, and to about 6000 in 1902.

I have confined my remarks up to this point almost wholly to the historical aspect of the question, but it will perhaps not be out of place for me to point out in conclusion some of the advantages which in my opinion are connected with the pursuit of university research.

Let us consider first the stimulating effect upon the individuals and institutions concerned. Among those who are affected by this stimulus should first be named the professor. Dr. Samuel Johnson was wont to compare accumulated knowledge to a heap of ice lying exposed to the summer sun, the bulk of which could not be maintained without constant replenishment. Continuing the figure, we can readily imagine that the professor's fund of knowledge which is ample enough for the class-room teaching of immature minds might shrink and trickle away until little is left but the sawdust which we usually associate with the preservation of that commodity. Under the stimulus of research this is impossible, for research into the new implies a full and minute mastery of that branch of knowledge in which the research is being conducted. Hence if no other advantage resulted a good case might be made out along this line of argument.

This stimulus to the professor would react with increased force upon the student. It was a favourite saying of a certain celebrated artist that those who follow after others rarely outstrip them. To hold up before the student either by theory or practice solely the ideal of acquiring what has already been learned is mediævalism pure and simple; it is to teach him to creep where he might walk upright and alone; it is to rob him in part of that intellectual birthright of independent thought which is the inheritance of every man, at least since the Renaissance. It is sometimes objected that the results attained by research students are often trivial or futile. I am disposed, however, to agree with a remark made by one of George Eliot's characters:—"Failure after long perseverance is much grander (and I would say parenthetically more useful) than never to have a striving good enough to be called a failure." It is sometimes also urged that research in the immature student leads to superficiality and conceit. I cannot but think this fear ill-grounded. It has been proved, on the contrary, that nothing will so quickly ripen and enlarge preliminary knowledge and so effectually extinguish presumption as the hand-to-hand struggle with some special problem in the department of study in which the student is already proficient.

Apart from the professor and student, the first effect of the inauguration of research work in our universities, if of the genuine stamp, will be felt upon the teaching profession of the country as a whole. Assuming an educated and interested public opinion, the premium so long placed upon memorised knowledge will disappear, and a change in the principle of selection of teachers both in universities and secondary schools will result.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

AFTER consultation with Mr. Astor, and in accordance with his wish, the council of University College, London, has resolved to endow the chair of pure mathematics and to name it the "Astor chair." The staff of the reorganised department of chemistry of the College will be as follows:—General and inorganic chemistry: professor, Sir William Ramsay, K.C.B., F.R.S.; assistant professors: Dr. F. G. Donnan, Dr. Morris Travers and Mr. E. C. C. Baly. Organic chemistry: professor, Dr. J. Norman Collie, F.R.S.; assistant professor, Dr. S. Smiles.

THE Royal Commissioners for the Exhibition of 1851 have made the following appointments to science research scholarships for the year 1902, on the recommendation of the authorities of the several universities and colleges:—University of Edinburgh, J. K. H. Inglis; University of Glasgow, A. Wood; University of St. Andrews, W. Wallace; University of Aberdeen, A. C. Michie; University of Birmingham, J. A. Lloyd; Yorkshire College, Leeds, H. D. Dakin; University College, Liverpool, F. Rogers; University College, London, E. P. Harrison; Owens College, Manchester, G. C. Simpson; Durham College of Science, Newcastle-on-Tyne, C. R. Dow; University College, Sheffield, G. B. Waterhouse; Queen's College, Galway, W. Goodwin; University of Toronto, W. C. Bray; Dalhousie College, Halifax, Nova Scotia, T. C. Hebb; University of Melbourne, R. Hosking; University of Adelaide, W. T. Cooke; University of New Zealand, M. A. Hunter. The following scholars nominated in 1901 have had their scholarships continued for a second year on receipt of a satisfactory report of work done during the first year:—F. Horton, A. Slator, R. B. Denison, G. Owen, G. Senter, F. W. Rixon, T. Baker, S. C. Laws, Alice E. Smith, J. Hawthorne, R. K. McClung, C. W. Dickson, G. Harker. The following scholars nominated in 1900 have had their scholarships exceptionally renewed for a third year:—Dr. W. M. Varley, Dr. S. Smiles, J. A. Cunningham, W. S. Mills, J. Patterson, J. Barnes.

THE Cambridge summer meeting organised by the Local Examinations and Lectures Syndicate was opened on Friday last with an address by the vice-chancellor, Dr. A. W. Ward, master of Peterhouse. Many men of distinction are taking part in the meeting, and the lectures cover a very wide range. The general subject of the meeting is "Some Aspects of Life and Thought in Europe and America in the Nineteenth Century." In the section of physical and natural sciences, the following lectures will be delivered during the meeting, which is divided into two parts, and ends on August 26:—"Some Modern Astronomical Speculations," Prof. G. H. Darwin, F.R.S.; "Sidereal Astronomy," Mr. Arthur Berry; "Meteorology in the Nineteenth Century," Dr. W. N. Shaw, F.R.S.; "Pasteur and his Work," Prof. Sims Woodhead; "An Aspect of the Influence of America on Geology," Dr. R. D. Roberts; "Progress of Geology in the Nineteenth Century as illustrated by modern views on (1) The Structure of the Earth's Crust, (2) The Evolution of the Configuration of the Surface," Mr. J. E. Marr, F.R.S.; "Advances of Botany," Prof. H. Marshall Ward, F.R.S.; "A Great Botanist: Sachs," Prof. W. B. Bottomley; "Colour Photography," Mr. T. B. Wood; "The Rise and Development of Electro-Chemistry," Mr. D. J. Carnegie. Among the subjects in the section of education are:—"Hygiene as a Factor in National Education," Miss A. Ravenhill; "Nature-Study" (Six Lectures), Prof. Patrick Geddes;

and "Illustrative Lectures in Nature-Study," Miss Von Wyss. There will be practical courses in nature-study (chemistry and botany) and in geography in its physical aspects. A conference upon the subject "In what sense can and ought Schools (Primary and Secondary) to prepare Boys and Girls for Life?" was opened by Dr. M. E. Sadler on Saturday last, and one on "Hygiene in Schools" will be opened by Miss Ravenhill on August 14.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 28.—M. Bouquet de la Grye in the chair.—On a curious property of a class of algebraic surfaces, by M. Émile Picard.—Reflection and refraction by a body transparent undergoing a rapid translation; equations of motion and some general consequences, by M. J. Boussinesq.—The reduction of nitro-derivatives by the method of direct hydrogenation in contact with finely divided metals, by MM. Paul Sabatier and J. B. Senderens. Nitronaphthalene is readily reduced to naphthylamine by hydrogen in presence of reduced copper at 350° C. With nickel the reduction goes further, ammonia and naphthalene tetrahydride being formed. Nitromethane and nitroethane are reduced completely to the corresponding amines.—A method of spectrum analysis capable of furnishing the still unknown law of rotation of planets of feeble brightness. Verification of the method, with preliminary results, by M. H. Deslandres. This method, which was applied with success in 1895 to the measurement of the rotation of the bright planets, has now been extended to those of lesser magnitude, including Uranus and Neptune.—The entire image of the planet submitted to spectrum analysis undergoes deformations from which the sense of the rotation can be determined, and to a certain extent its velocity. The rotation of Uranus has been found to be retrograde.—On the problem of Dirichlet for domains limited by several contours or surfaces, by M. A. Korn.—On one of the causes of the explosion of steam boilers and on a means of preventing it, by M. J. Fournier. It is shown that with the ordinary form of safety valve the release may take place in the normal way, and yet an insufficient amount of steam may escape to prevent the pressure rising to a dangerous extent. A modification of the ordinary safety valve is described in which this difficulty is overcome.—On magnetic dichroism, by M. Quirino Majorana. Active liquids behave in a magnetic field like uniaxial crystals possessing dichroism.—On the electrochemical equivalent of silver, by M. A. Leduc. A short account of researches the complete description of which will be published shortly in the *Journal de Physique*, in which the effect of temperature changes, current density, and acidity of the bath upon the value of the electrochemical equivalent of silver has been determined.—The silvering of glass and daguerreotype, by M. Izarn. A minute description of the method of silvering glass by means of ammoniacal silver nitrate and solutions of formaldehyde.—On the precipitation of the chlorides and bromides of cadmium, mercury and tin by sulphuric acid, by M. Georges Viard.—On mannite, the nitrates and the alkaloids of normal urine, by M. S. Dombrowski. By applying the method of separation described in a previous note the author has succeeded in isolating from urine sodium nitrate, cadaverine, mannite and a new alkaloid.—An attempt at an immediate analysis of nerve-tissue, by M. N. Alberto Barbieri.—On the ligature of the appendicular extremity of the cæcum in *Cercopithecus cephus*, by M. Jean Maumus.—The internal secretion of the testicle in the embryo and in the adult, by M. Gustave Loisel.—The microbial kinases; their action on the digestive power of the pancreatic juice together with albumin, by M. C. Delezenne.—The parasitic nature of certain calcareous degenerations, of some inflammatory tumours and of special lesions of the skeleton, by MM. A. Charrin and G. Delamare.—A comparative study of hæmatolysis by poisons in the dog and rabbit, by M. C. Phisalix.—On a new form of tactile sensibility, trichesthesia, by MM. N. Vaschide and P. Rousseau.—On the possibility of combating mildew and oidium of the vine by a liquid treatment, by M. J. Guillon.—On a method of concentrating wine, by MM. Baudoin and Schribaux. The method which was found to give the best practical results consisted in first partially distilling the wine at a low temperature and then removing some water from the distillate by freezing.—The prehistoric drawings in the grotto of La Mouthe, Dordogne, by M. Émile Rivière. Facsimiles of drawings of a reindeer and of a horse are given.

NEW SOUTH WALES.

Royal Society, June 4.—Prof. Warren, president, in the chair.—The parks of Sydney; some of the problems of control and management, by Mr. J. H. Maiden.—A possible connection between volcanic eruption and sunspot phenomena, by Mr. H. I. Jensen. The author of this paper mentions that the idea of the existence of such a connection was suggested to him by the fact that Vesuvius was in violent eruption in the years 1813, 1822, 1855, 1867, 1891 and 1900, all of which were minimum years. By means of a chart he shows that earthquakes and eruptions are most violent, numerous and extensive when there is least sunspot activity. Though seismic disturbances do occur at all times, they seem for the last hundred and twenty years to have been most severe around the minimum years—1811, 1822, 1833-4, 1844, 1855-6, 1867-8, 1878-9, 1888-9 and 1900-2—large groups of great earthquakes and eruptions having taken place in and about these years. On the other hand, the chart also shows that in years of maximum, like 1893-8, 1884-5, 1869-71, 1858-65, and so on, these phenomena have been comparatively few and unimportant. The author thinks that the cause of this connection between solar and seismic disturbances is that in years of sunspot minimum there is less heat, and other energy, received from the sun, and consequently there is more rapid radiation from the earth, causing quicker cooling, hence more cracking of the earth's crust. He also suggests that the earth's atmosphere exerts a greater squeeze on the crust in years of minimum, thus forcing lava out of fissures.

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